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ABSTRACT

This curriculum guide was developed to provide environmental education through a series of hands-on activities for the classroom and the outdoor setting of Mount Mitchell State Park, North Carolina. This activity packet, designed for grades 4 through 6, meets established curriculum objectives of the North Carolina Department of Public Instruction's Standard Course of Study. Students are exposed to the following major concepts: spruce-fir forest ecosystems, preservation of natural areas, natural resources management, and stewardship of natural resources. The packet is divided into eight sections: (1) introduction to the North Carolina State Parks System, Mount Mitchell State Park, and the activity packet; (2) activity summary; (3) pre-visit activities; (4) on-site activities; (5) post-visit activities; (6) vocabulary and definitions; (7) references; and (8) a scheduling worksheet, parental permission form, and program evaluation. Activity information includes curriculum objectives for each grade level, location, group size, estimated time, appropriate season, materials, major concepts, objectives, educator's information, student's information, and worksheets. (LZ)

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Mount [illegible]

An Environmental [illegible] Experience

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"Of course, science doesn't really explain why things are the way they are. The most we can hope for, and we ought to be grateful for achieving so much, is to connect bits of nature's grand design to each other by discovering resemblances among them."

- Hans Christian von Baeyer,
The Ocean, the Stars, and the Kitchen Sink

"All science is the search for unity in hidden likenesses."

- Jacob Bronowski,
The Ascent of Man

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CP&L

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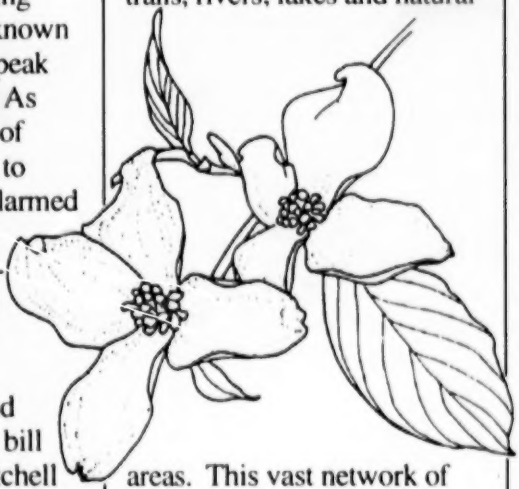
Introduction to the North Carolina State Parks System

Preserving and protecting North Carolina's natural resources is actually a relatively new idea. The seeds of the conservation movement were planted early in the 20th century when citizens were alerted to the devastation of Mount Mitchell. Logging was destroying a well-known landmark - the highest peak east of the Mississippi. As the magnificent forests of this mile-high peak fell to the lumbermen's axe, alarmed citizens began to voice their objections. Governor Locke Craig joined them in their efforts to save Mount Mitchell. Together they convinced the legislature to pass a bill establishing Mount Mitchell as the first state park of North Carolina. That was in 1915.

The North Carolina State Parks System has now been established for more than three quarters of a century. What started out as one small plot of public land has grown into 59 properties across the state, including parks, recreation areas, trails, rivers, lakes and natural areas. This vast network of land boasts some of the most beautiful scenery in the world and offers endless recreation opportunities. But our state parks system offers much more than scenery and recreation. Our lands and waters contain unique and valuable archaeological, geological and biological resources that are important parts of our natural heritage.



As one of North Carolina's principal conservation agencies, the Division of Parks and Recreation is responsible for the more than 125,000 acres that make up our state parks system. The Division manages these resources for the safe enjoyment of the public and protects and preserves them as a part of the heritage we will pass on to generations to come.

An important component of our stewardship of these lands is education. Through our interpretation and environmental education services, the Division of Parks and Recreation strives to offer enlightening programs which lead to an understanding and appreciation of our natural resources. The goal of our environmental education program is to generate an awareness in all individuals which cultivates responsible stewardship of the earth.

For more information contact:

N.C. Division of Parks and Recreation
P.O. Box 27687
Raleigh, NC 27611-7687
919/ 733-4181

Introduction to Mount Mitchell State Park

In the crest of the billion year old Black Mountain range lies the summit of Mount Mitchell, the highest point east of the Mississippi. This lofty peak is the focal point of the 1,677 acre Mount Mitchell State Park.

Mount Mitchell State Park is the oldest state park in the southeastern United States. It was established in 1915 by the North Carolina General Assembly for the preservation and protection of the unique spruce-fir forests located there. The two highest peaks of the eastern United States are located within the boundaries of the park: Mount Mitchell at 6,684 feet and Mount Craig at 6,647 feet.

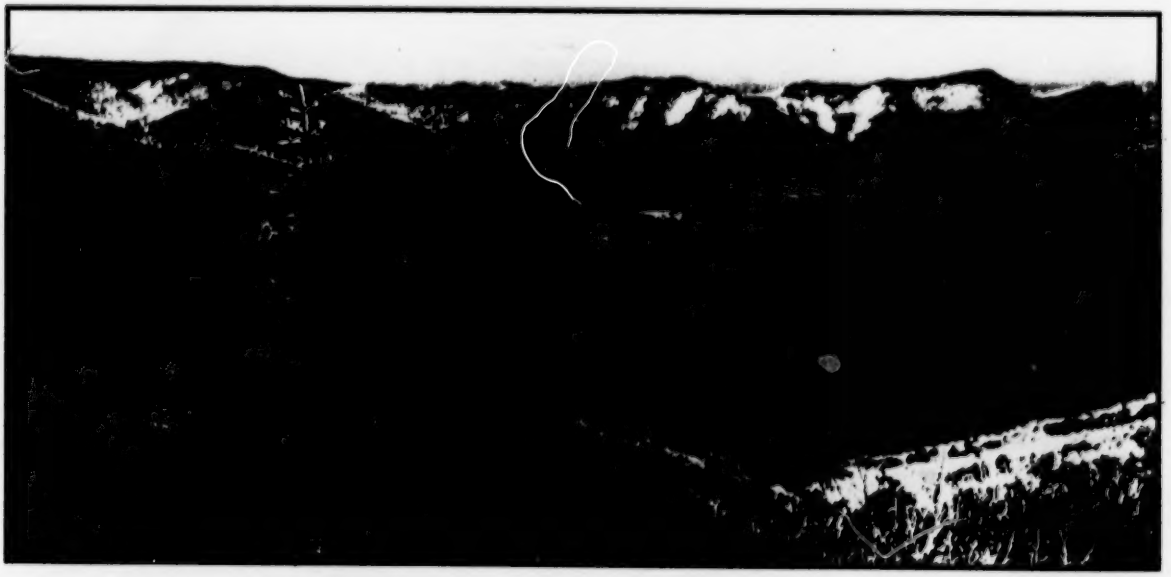
Mount Mitchell is located in Yancey County, 34 miles northeast of Asheville off the Blue Ridge Parkway on North Carolina Highway 128.

The Park as an Outdoor Classroom

Numerous recreation facilities and a variety of educational opportunities make a visit to Mount Mitchell a rewarding adventure. The natural resources of this unique mountainous area open the door to a world of learning and discovery. One of the most outstanding natural features of the park is its high elevation. Because temperature decreases as altitude increases, the climate of Mount Mitchell is similar to that of southern Canada.

Mount Mitchell State Park has a unique natural history and is an excellent place to study geology, ecology, biology and environmental issues. The park is also rich in cultural resources and provides a wonderful outdoor classroom for learning about history, literature and recreation. Students can study and learn about these and other subjects on a hands-on basis.

Groups are encouraged to visit the park during the warmer months of the year for hikes, exploration, nature study and other activities. Leaders may choose to design and conduct their own activities or make use of the park's Environmental Education Learning Experience packet. A park ranger will be happy to meet with your group upon arrival to answer any questions the students may have, or welcome the group and present a short talk. Park staff will make every effort to accommodate persons with disabilities.



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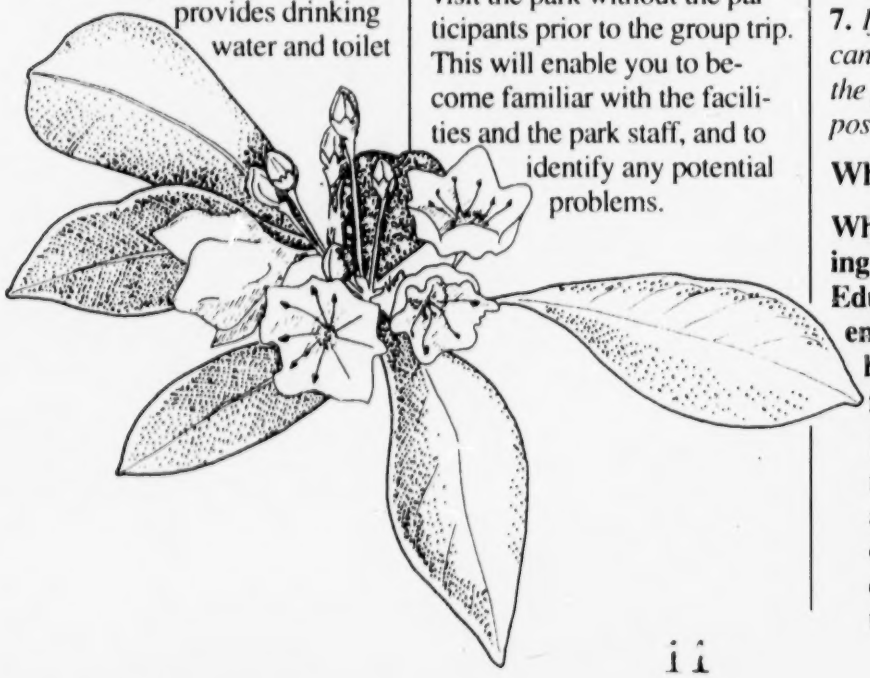
Park Facilities:

Restrooms: Restrooms are available at the park office, the restaurant, and concession stand.

Picnic Area: A picnic area is located at the north end of the summit parking lot. It contains forty picnic tables, several stone grills, drinking water and two picnic shelters which can accommodate 16 people each. All are available on a first-come basis although shelters may be reserved. Use of the shelters is free of charge unless you want to reserve them.

Family Camping: Family camping is available from May 1 to October 31 on a first-come basis. Each of the nine campsites has a grill, picnic table and a gravel pad for tents. The campsites are located a short distance from the campground parking lot. A centrally located washhouse provides drinking water and toilet facilities. This washhouse is closed during the winter. Electric and water hookups are not available.



Scheduling a Trip:

1. Please contact the park at least two weeks in advance to make a reservation.

2. Complete the Scheduling Worksheet located on page 8.1, and return it to the park as soon as possible.

3. Research Activity Permits may be required for sampling activities. If your group plans to collect any plant, animal or mineral within the park, please contact the park office at least 30 days in advance to obtain a permit application.

Before the Trip:

1. Complete the pre-visit activity in the Environmental Education Learning Experience.

2. The group leader should visit the park without the participants prior to the group trip. This will enable you to become familiar with the facilities and the park staff, and to identify any potential problems.

3. The group leader should discuss park rules and behavior expectations with adult leaders and participants. Safety should be stressed.

4. Everyone should wear a name tag. Please color-code tags (for groups) and establish a buddy system.

5. Activities that take place outdoors may expose participants to insects and seasonal weather conditions. The high altitude makes the climate of Mount Mitchell quite cold even in summer. Be prepared by dressing accordingly and wearing sunscreen and/or insect repellent, if necessary. Comfortable walking shoes should also be worn.

6. *The group leader is responsible for obtaining a parental permission form from each participant, including a list of any health considerations and medical needs.* An example of this form is on page 8.2.

7. *If you will be late or need to cancel your trip, please notify the park as far in advance as possible.*

While at the Park:

Whether your class is working on an Environmental Education Learning Experience or taking a nature hike, please obey the following rules:

1. To help you get the most out of the experience and increase the chance of observing wildlife, be as quiet as possible while in the park.

2. On hikes, walk behind the leader at all times. Running is not permitted.

3. All plants and animals within the park are protected. Breaking plants and harming animals are prohibited in all state parks. This allows future visitors the same opportunity to enjoy our natural resources.

4. Picnic in designated picnic areas only. Help keep the park clean and natural; do not litter.

5. *In case of accident or emergency, contact park staff immediately.*

Following the Trip:

1. Complete the post-visit activity in the Environmental Education Learning Experience packet.

2. Build upon the field experience and encourage participants to seek answers to questions and problems encountered at the park.

3. Relate the experience to classroom activities and curriculum through reports, projects, demonstrations, displays and presentations.

4. Give tests or evaluations, if appropriate, to determine if students have gained the desired information from the experience.

5. File a written evaluation of the experience with the park. Evaluation forms are available in the activity packet on page 8.3.

Park Information:

Mount Mitchell State Park
Route 5, Box 700
Burnsville, NC 28714
Tel: (704) 675-4611
Fax: (704) 675-4611

Office Hours:

8:00 a.m.- 5:00 p.m.
Monday - Friday

Hours of Operation:

Nov - Feb	8:00 a.m. - 6:00 p.m.
Mar, Oct	8:00 a.m. - 7:00 p.m.
Apr,May,Sep	8:00 a.m. - 8:00 p.m.
Jun - Aug	8:00 a.m. - 9:00 p.m.

red-tailed hawk

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Introduction to the Activity Packet for Mount Mitchell State Park

The Environmental Education Learning Experience, *Alpine Forest,* provides a series of hands-on activities for the classroom and the outdoor setting of Mount Mitchell State Park. This activity packet, designed for grades 4 through 6, meets established curriculum objectives of the North Carolina Department of Public Instruction's Standard Course of Study. Three types of activities are included:

1) pre-visit activity
2) on-site activity
3) post-visit activity

The on-site activity will be conducted at the park, while pre-visit and post-visit activities are designed for the classroom. Pre-visit activities should be introduced prior to the park visit so that students will have the necessary background and vocabulary for the on-site activities. We encourage you to use the post-visit activities to reinforce concepts, skills and vocabulary learned in the pre-visit and on-site activities. These activities may be performed independently; however, they have been designed as a series to build upon the students' newly gained knowledge and experiences.

The Environmental Education Learning Experience, *Alpine Forest,* will expose the students to the following major concepts:

- **Spruce-Fir Forest Ecosystems**
- **Preservation of Natural Areas**
- **Natural Resource Management**
- **Stewardship of Natural Resources**

The first occurrence of vocabulary words used in these activities is indicated in **bold type**. Their definitions are listed in the back of the activity packet. A list of the reference materials used in developing the activities follows the vocabulary list.

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Note:
The on-site activity will require hiking which could expose the students to cold conditions, ticks and other insects. Accessibility to some of these areas may be difficult for persons with special needs. When conducting the on-site activity, please remember that collecting specimens of any kind in the park is prohibited.

striped skunk

Activity Summary

The following outline provides a brief summary of each activity, the major concepts introduced and the objectives met by completion of the activity.

I. Pre-Visit Activity

#1 Canada Down South (page 3.1.1)

In this activity, students will play a card game to learn about the changes in natural communities at different elevations in the Southern Appalachians.

Major concepts:

- Natural communities
- Community diversity with change of elevation
- Identifying plants and animals

Objectives:

- Describe five different natural communities you would encounter as you ascend Mount Mitchell.
- Name four plants and four animals from each of these natural communities.
- List two environmental factors which bring about changes in natural communities between 0 and 6000 feet above sea level in North Carolina.

II. On-Site Activity

#1 Meet A Tree (page 4.1.1)

The students will collect data from several small plots along the Balsam Nature Trail at Mount Mitchell State Park. They will identify each tree species within the plot and estimate each tree's diameter. Students will also measure the pH of the soil in their plot.

Major Concepts:

- Ecology of the spruce-fir forests of the Southern Appalachians
- Plot sampling methods
- Soil pH

Objectives:

- Identify the four most common trees on Mount Mitchell.
- Determine the number of trees in a plot.
- Measure each tree's diameter at 4 1/2 feet above the ground.
- Determine soil pH.

III. Post-Visit Activity

#1 Forest Game (page 5.1.1)

Through a game, students will experience some of the factors limiting tree growth.

Major concepts:

- Environmental factors affecting forest growth

Objectives:

- List five elements that can adversely affect natural communities.
- List three ways to help protect the spruce-fir forest.

Pre-Visit Activity #1 — Canada Down South

Curriculum Objectives:

Grade 4
- Communication Skills: listening, reading, vocabulary and viewing comprehension, study skills using environmental sources
- Guidance: competency for interacting with others
- Science: living things—animals, adaptation to environment, weather and climate
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Grade 5
- Communication Skills: listening, reading, vocabulary and viewing comprehension, study skills using environmental sources, competency for interacting with others
- Science: living things—plants, earth science, environment
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Grade 6
- Communication Skills: listening, reading, vocabulary and viewing comprehension, study skills using environmental sources
- Guidance: competency and skill for interacting with others,
- Healthful Living: environmental health,
- Science: ecology
- Social Studies: gather, organize and analyze information, draw conclusions

Location: Classroom

Group Size:
30 students, class size

Estimated Time: 20 minutes

Appropriate Season: Any

Materials:
Provided by the Educator:
Per group: "Mountain Community Fact Sheet", one deck of "Mountain Community Cards"

Major Concepts:
- Natural communities
- Community diversity with change of elevation
- Identifying plants and animals

Objectives:
- Describe five different natural communities you would encounter as you ascend Mount Mitchell.
- Name four plants and four animals from each of these natural communities.
- List two environmental factors which bring about changes in natural communities between 0 and 6000 feet above sea level in North Carolina.

Educator's Information:

In this card game, students will learn about the plants and animals that make up five different **natural communities** in the **piedmont** and mountain regions of the southeastern United States. They will learn which plants and animals are common to several natural communities and which are found only in one community.

Instructions:

1. Divide the class into groups of four. Copy the "Mountain Community Cards" to make one set of 60 cards for each group. Cut the cards apart as indicated and laminate them for durability. Have the students read the Student's Information sheet, then hand out a copy of the Mountain Community Fact Sheet to each student.

2. Explain to the students that the object of the game is for each player to make as many natural community "books" as possible out of the cards in his or her hand. The students will need to refer to their Mountain Community Fact Sheet to determine which cards will make a book. A book consists of four cards that all come from the same community type. The four cards must be different plants or animals from the same community type. Books are laid down on the table face up.

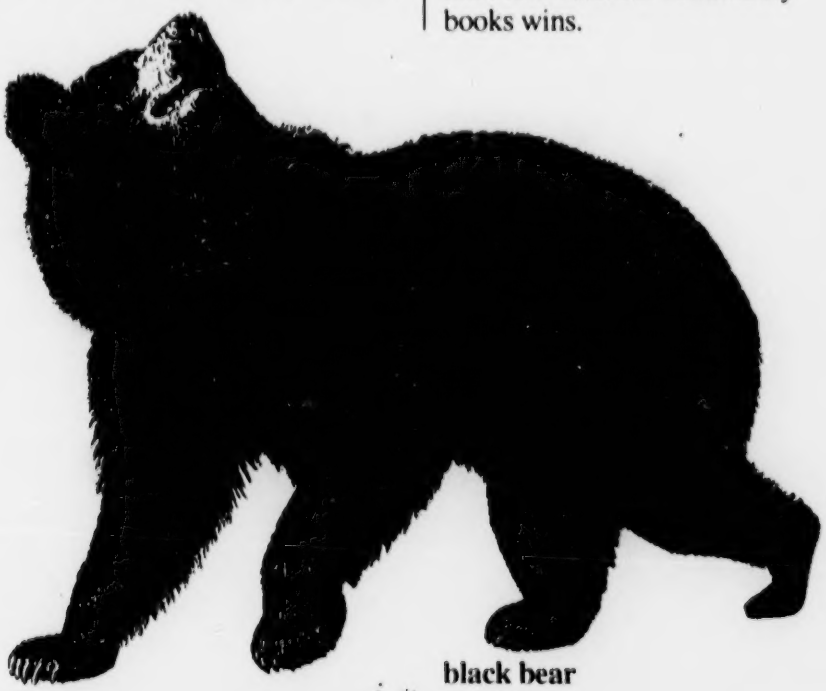
3. To play the game, the dealer deals eight cards to each player, starting with the player on the dealer's left. Have the dealer place the leftover cards in a stack face down in the center of the table, with the top card turned over and placed beside the stack as the start of the discard pile.

The player to the right of the dealer starts the game. He or she will draw a card from the stack or pick a card from the discard pile. If the player can use the new card, he or she does so, laying down any natural community books held. When laying down a book, the player must name aloud the natural community it represents. He or she will then discard one card into the discard pile, face up. If a card drawn from the stack cannot be used, it can be discarded. Play continues in this manner.

4. If a player has two or three cards from one natural community, and another card from that same natural community is placed on the discard pile by the player whose turn was immediately before him or her, the player may pick up the entire discard pile, after showing the two or three cards as proof. The player must then put the whole discard pile in his or her hand, using as many cards as possible to make books. The player then discards one card.

5. When the stack has been used up, the discard pile is shuffled, then turned over and used as the stack. Play continues until there is no longer a stack or discard pile or when only one player is left holding cards.

6. The player with the greatest number of natural community books wins.



black bear

Student's Information

Would you believe that you can travel to a place very much like southern Canada and still be in North Carolina? You can, and here's why:

During the past two million years, erosion and other forces have changed the mountains of North Carolina. During the last Ice Age, glaciers (wide, thick rivers of ice) covered much of what is now the northern United States. As these glaciers slowly moved south from the polar regions to present day Illinois and Indiana, they brought colder weather into the southern United States.

Some animals and plants that lived in the north spread south ahead of the glaciers, since the weather was warmer in that direction. Although the climate in the South was colder during the Ice Age than it had been previously, it was not as cold as the climate in northern places that were covered by the glaciers. Animals and plants from the North were able to live in areas that had been too warm for them before the Ice Age.

Thousands of years passed, and the earth gradually warmed up. The glaciers shrank as they melted back to the far North, and the climate in the South warmed up again. Some cold-weather plants and animals followed the melting glaciers north. Others could now live only in the coldest places in the South - mountain tops above 5500 feet, such as those of the Black Mountains.

Today we still find plants and animals in North Carolina which are **adapted** to cold weather similar to that in the northernmost United States and southern Canada. They live on the peaks of the southern Appalachian mountains. Some of these plants and animals have changed over time into distinct species and live nowhere else in the world.

The plants and animals that live at the top of these mountains are adapted to the cold, whereas the plants and animals that live in the valleys are adapted to a warmer climate. Between these valley and mountain communities is a **gradient** in weather conditions from warm to cold, with a wide variety of plants and animals living along this gradient.

If you were to travel all the way from North Carolina to Canada by car, you would notice that the plants growing by the roadside and in fields and forests would begin to look different as you traveled farther north. That's because the average temperature drops around 3 degrees **Fahrenheit** for every 300 miles that you travel north. The farther north, the cooler the climate. Plants that grow well in the lower elevations of North Carolina gener-

ally do not do well in southern Canada. On the other hand, cold-loving plants that thrive in southern Canada would find North Carolina's climate in the piedmont or coastal plain too hot. But traveling north is not the only way to find a cooler climate. Here's how you can take a quick trip to a forest like that of southern Canada without ever leaving North Carolina. If you were to climb 1,000 feet up the side of a mountain, you would find the climate approximately 3 degrees Fahrenheit cooler than it was where you started. If you began your trip at sea level and kept going until you reached the top of a 6,000 foot mountain, how much cooler would it be at the top than it was at the beach where you started (0 feet altitude)?

Solution

Step 1: 6000 ft ÷ 1000 ft = 6

Step 2: 6 x 3° = 18°

Answer: *The temperature would be 18° F cooler at the top of the mountain.)*

Suppose you were to hike The Mount Michell Trail which starts at the Black Mountain Campground near Busick (2800 feet above sea level) and ends at the summit (6684 feet above sea level). You would pass through the same types of forests and climate changes as you would if you drove north to southern Canada! There is about 12 degree Fahrenheit difference in temperature from the base of Mount Mitchell to its summit.

Here's how to calculate the temperature drop on the trail:

Step 1: Find the difference in elevation between the summit and the Black Mountain Campground at the base of the trail: 6,684 - 2,800 = 3,884

Step 2: 3,884 ft. ÷ 1000 ft = 3.9

Step 3: 3.9 x 3° = 11.7°F

The "**Mountain Community**" fact sheet lists some of the plants and animals which live in the natural communities found on the slopes of the Black Mountain Range. Some of these plants and animals are found in only one type of natural community. For example, red spruce trees are found only in the **spruce-fir forest** community. In the Southern Appalachians, spruce-fir forests only occur above 5500 feet. Some animals, such as the white-tailed deer, are so adaptable they can be found from the coast to the cool mountain tops, living in all the natural communities.

You will be playing a game where you match up four cards representing four members of the same natural community. Five different natural communities found on the slopes of the Black Mountain Range are represented in this game: **oak-hickory forests**, **cove hardwood forests**, **northern hardwood forests**, mountain **balds**, and spruce-fir forests. There are more than five natural communities found in the Black Mountains, but only five are used in this game.

Mountain Community Fact Sheet

Here are five natural communities found at different elevations on the slopes of the Black Mountains:

Oak-Hickory Forest

At lower elevations (below 3,500 feet), we find oak-hickory forests. These forests occur over the southern- and eastern-facing outer slopes of the Blue Ridge Mountains below 3,500 feet and in the interior mountain basins. The most common trees are white, red and chestnut oaks, but black and scarlet oaks are plentiful as well. In the oak-hickory forests we find:

white oak	gray squirrel	red oak
black bear	red maple	white-tailed deer
pignut hickory	wild turkey	white pine
striped skunk	raccoon	box turtle

Cove Hardwood Forest

In especially damp areas at lower elevations, we find cove hardwood forests. These forests occur in the Southern Appalachians in sheltered mountain valleys on north- and east-facing slopes from 1,500 to 4,500 feet. Cove forests are among the richest, most magnificent deciduous forest found anywhere on earth. This forest includes:

American beech	white-tailed deer	red oak
gray squirrel	yellow poplar	box turtle
sugar maple	black bear	

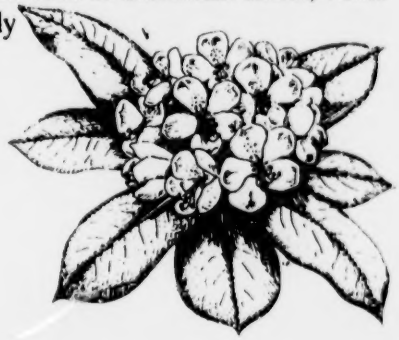
Northern Hardwood Forest

At higher elevations, between 3,500 and 5,500 feet, we find northern hardwood forests. These forests are like those found in the New England states. In them we find:

American beech	box turtle	sugar maple
spotted salamander	yellow birch	black bear
eastern hemlock	red squirrel	white-tailed deer
New England cottontail rabbit	gray squirrel	raccoon

Mountain Balds

At these same elevations (3,500 - 5,500 ft.) we find some mountain tops that have few or no trees at all. These are called balds. There are two very different types of balds: heath balds and grassy balds. Heath balds are mainly composed of woody shrubs such as mountain laurel, while grassy balds are composed of grass, mosses and other nonwoody plants. Plants and animals found on balds include:



- grasses
- wild turkey
- mountain laurel
- saw-whet owl
- rhododendron
- meadow jumping mouse
- white-tailed deer
- sedges
- red-tailed hawk
- eastern cottontail rabbit
- screech owl
- peregrine falcon

Spruce-Fir Forest

At the highest elevations of the Southern Appalachians, over 5,500 feet, we find spruce-fir forests. These are like the forests in southern Canada and the northern United States. In these forests we find:

- red spruce
- junco
- yellow birch
- yellow coneflower
- saw-whet owl
- Fraser fir
- cedar waxwing
- mountain laurel
- northern flying squirrel
- mountain ash
- rhododendron
- long-tailed weasel
- black bear
- white-tailed deer
- New England cottontail rabbit
- red squirrel

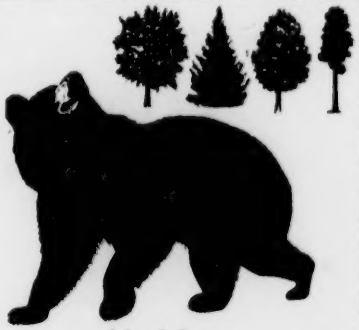
Mountain Community Cards

American beech

black bear

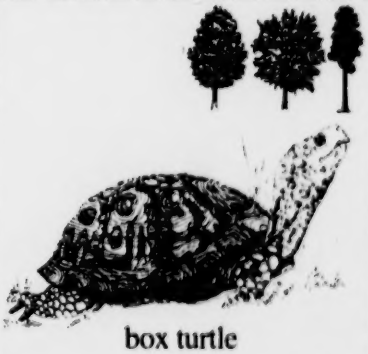
box turtle

American beech


black bear

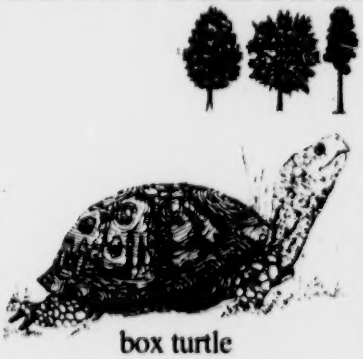
cedar waxwing

black bear


box turtle

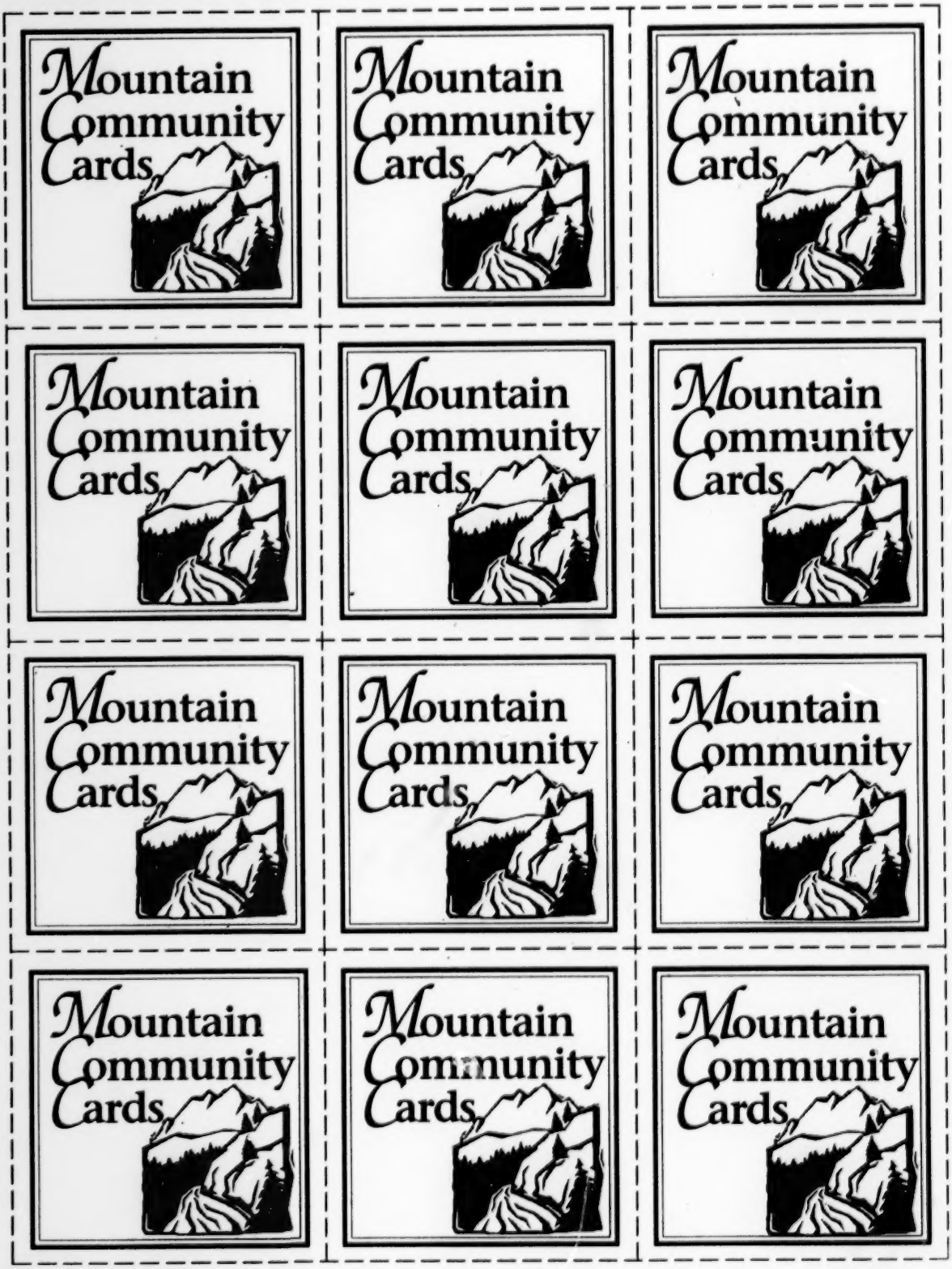
eastern cottontail rabbit

black bear


box turtle

eastern hemlock

Mountain Community Cards - Backing Sheet



Mountain Community Cards

striped skunk

gray squirrel

meadow jumping mouse

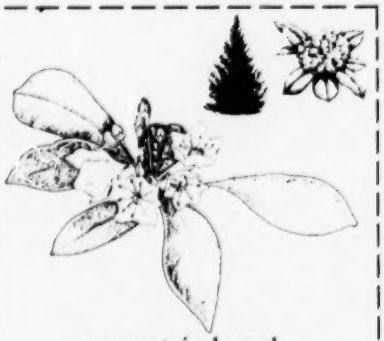
Fraser fir

gray squirrel

mountain ash

grasses

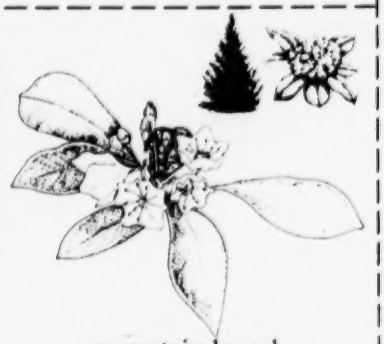
junco



mountain laurel

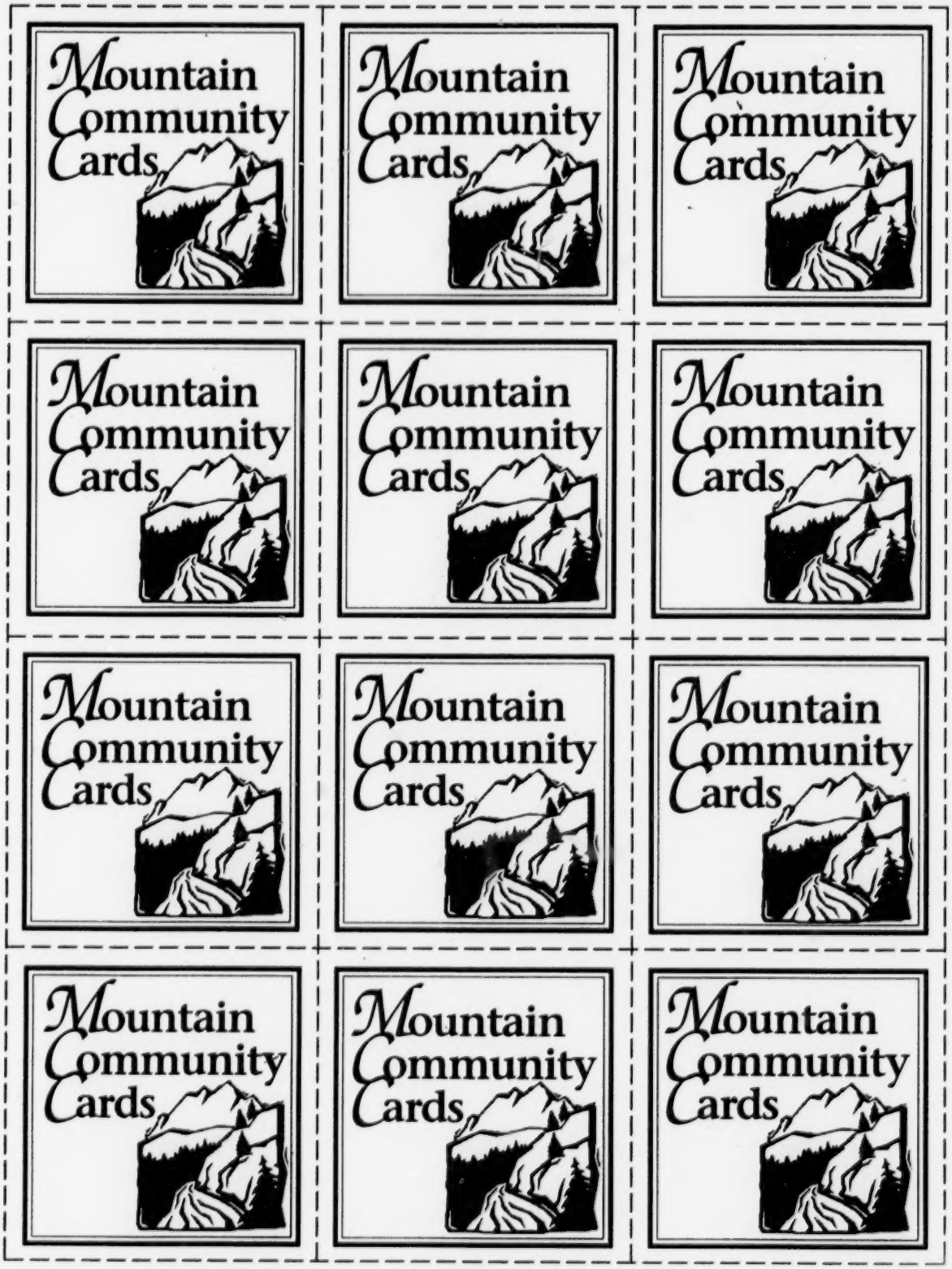
gray squirrel

long-tailed weasel



mountain laurel

Mountain Community Cards - Backing Sheet



Mountain Community Cards

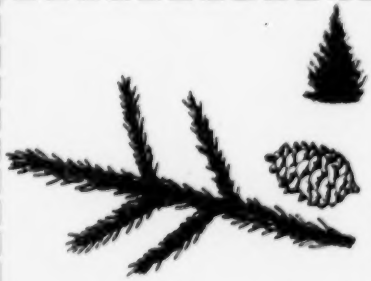
New England cottontail rabbit

pignut hickory

red maple

New England cottontail rabbit

raccoon



red spruce

northern flying squirrel

raccoon

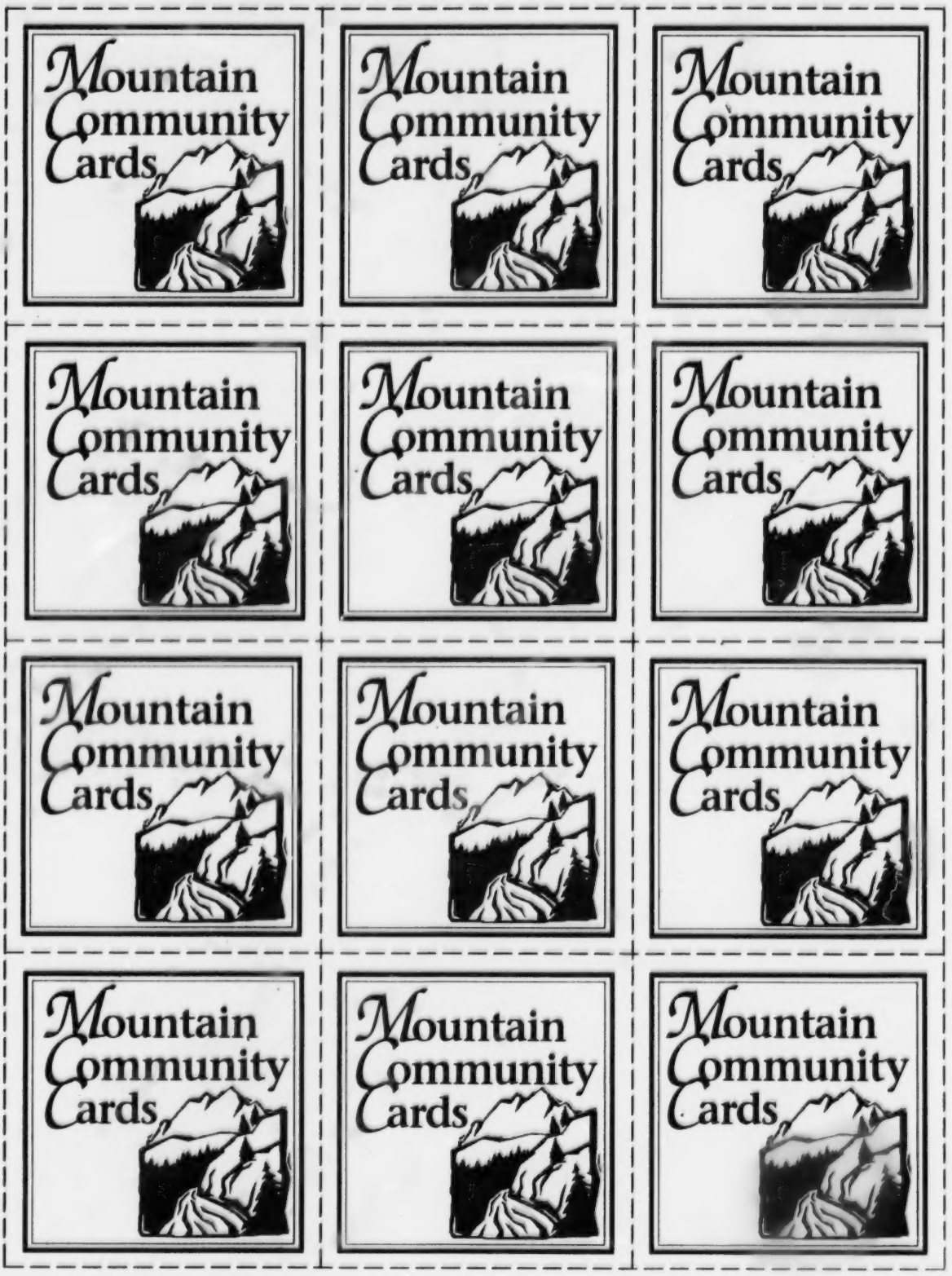
red squirrel

peregrine falcon

white pine

red squirrel

Mountain Community Cards - Backing Sheet

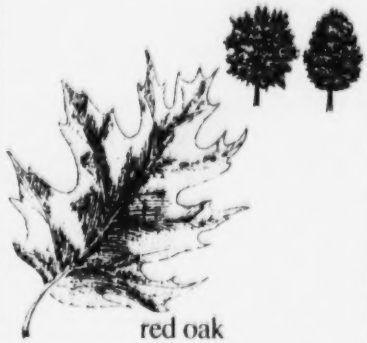


Mountain Community Cards

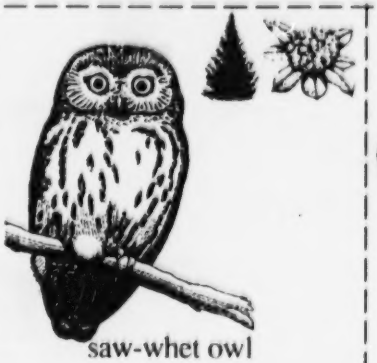
red-tailed hawk

rhododendron

sedges



red oak



saw-whet owl

spotted salamander

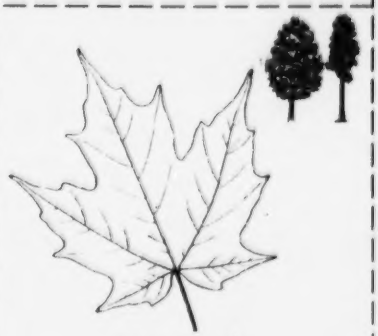
red oak

saw-whet owl

sugar maple

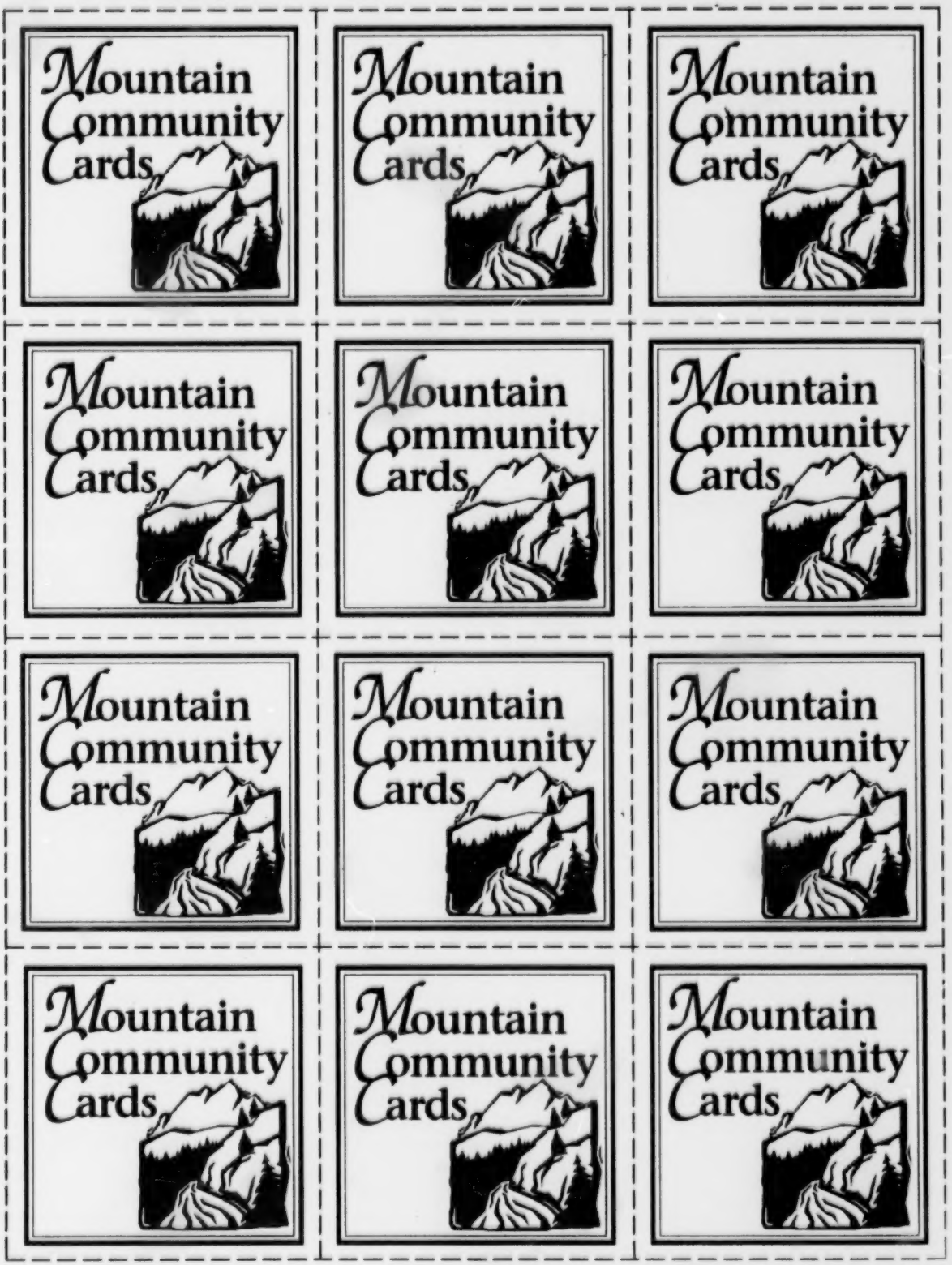
rhododendron

screech owl



sugar maple

Mountain Community Cards - Backing Sheet



Mountain Community Cards

white oak

white-tailed deer

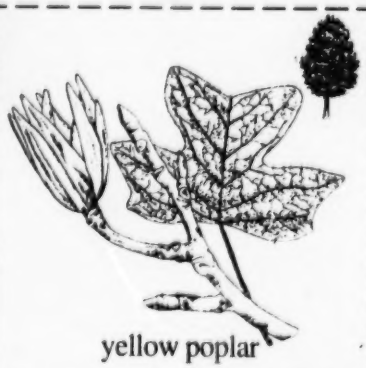
wild turkey

white-tailed deer

white-tailed deer

yellow birch

white-tailed deer



yellow poplar

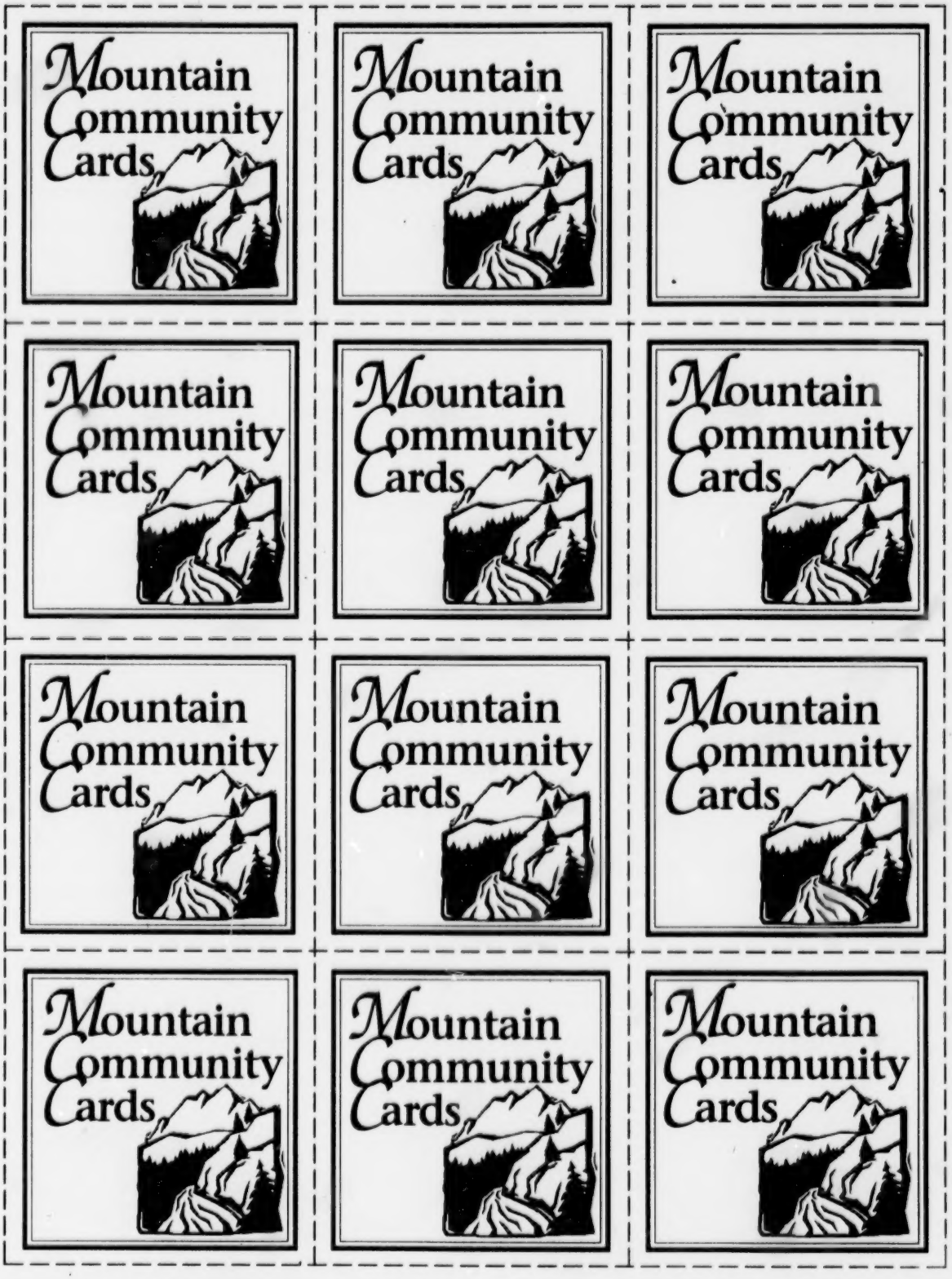
yellow birch

white-tailed deer

wild turkey

yellow coneflower

Mountain Community Cards - Backing Sheet



On-Site Activity #1 — Meet A Tree

Curriculum Objectives:

Grade 4
- Communication Skills: listening, reading, vocabulary and viewing comprehension
- Guidance: competency for interacting with others
- Healthful Living: recreational safety
- Mathematics: solve problems in measurement
- Science: adaptation to environment, weather and climate
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Grade 5
- Communication Skills: listening, reading, vocabulary and viewing comprehension
- Guidance: competency for interacting with others
- Healthful Living: recreational safety
- Mathematics: solve problems in measurement
- Science: living things—plants, interdependence of plants and animals, Earth science, environment
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Grade 6
- Communication Skills: listening, reading, vocabulary and viewing comprehension
- Guidance: competency and skill for interacting with others
- Healthful Living: recreational safety
- Mathematics: solve problems in temperature and measurement
- Science: ecology
- Social Studies: gather, organize and analyze information, draw conclusions

Location:
Mount Mitchell State Park, Balsam Trail

Group Size:
30 or smaller, class size; students should be separated into groups of three

Estimated Time:
45-60 minutes

Appropriate Season:
Late spring to late fall

Materials:
Provided by the park:
Per group: string, litmus paper, litmus color chart, distilled water, paper cups, pencils, clipboards, ruler, map of the Balsam Trail
Provided by the educator:
Per group: "Alpine Forest Fact Sheet," "Alpine Forest Worksheet," calculator, pencils
Per class: poster-size "Alpine Forest Data Summary Table"

Major Concepts:
- Ecology of the spruce-fir forests of the Southern Appalachians
- Plot sampling methods
- Soil pH

Objectives:
- Identify the four most common trees on Mount Mitchell.
- Determine the number of trees in a plot.
- Measure each tree's diameter at 4 1/2 feet above the ground.
- Determine soil pH.

Educator's Information:

The students will record information about the plants and soil found within assigned **plots** along the **Balsam** Trail.

Using the "**Alpine** Forest Fact Sheet," each student team will identify the different plant species within their plot. They will also estimate the **diameter** of each live tree and determine the soil **pH** in their plot. The teams will share their data with the rest of the class. Together, they will summarize what they learned about Mt. Mitchell's alpine forest.

Special Considerations:
This activity requires a short hike along a trail. Students with physical disabilities should have no problem getting to the site, but may have difficulty with the activity as it occurs on the uneven ground along a trail. It is recommended that students wear sturdy shoes, a hat with a visor, old clothes and sunscreen. Be prepared for rainy, cool weather and dress accordingly.

BEST COPY AVAILABLE

Instructions:

1. Students should read the Student's Information, the "Alpine Forest Fact Sheet," and the instructions on the "Alpine Forest Worksheet" before arriving at the park. If possible, the students should practice measuring the diameter of different trees on the school grounds as explained in the worksheet instructions.

2. Make a poster-sized "Alpine Forest Data Summary Table." (See page 4.1.10.) Divide the class into groups or teams of three. The teacher may wish to assign specific roles to individual group members, such as data recorder (records data and does calculations), soil scientist (determines soil pH), and forester (identifies and measures trees). Although group members will work together as a team to accomplish the tasks described on the worksheet, individual members could take responsibility for organizing and conducting specific tasks. Give the groups time to read the worksheet instructions together and discuss how they will get their work done while at Mt. Mitchell. **Make sure students read the warning about dead trees and discuss how to work safely around them.**

3. Upon arriving at the summit parking area, a restroom break is suggested before beginning the on-site activity. After the break, ask the students to get into their groups. Work with the park ranger to distribute the necessary materials (see Materials section). **STUDENTS SHOULD BE CAUTIONED NOT TO TOUCH DEAD TREES DURING THEIR PLOT STUDY!**

4. Have each group complete the top portion of their "Alpine Forest Worksheet" and answer question #1 about the weather conditions. The weather gauges are located in the breezeway of the concession stand.

5. Assign each group a number. These numbers correspond to numbered posts along the Balsam Trail. The post will be the center of that group's plot.

6. Have the groups locate their pre-assigned numbered post on the Balsam Trail map. After the students locate their post on the map, the students must find their assigned post on the trail.

7. Each group of students should have a 15-foot section of string. With one student (data recorder) holding the end of the string on the post, another student will pull the string tight so that he or she is standing 15 feet from the post. After noting where he or she started, the student will make a circle around the post while holding onto the string. Every time the string touches a tree, the students will record what species of tree it is on the "Alpine Forest Worksheet."

8. When the string touches a tree, the students will also measure the diameter of the tree, by taking the ruler and holding it at eye level (approximately 4 1/2 feet from the ground) against the tree. They will record the estimated diameter on their worksheet.

9. After all the data is collected and worksheets are completed, gather the students together at the concession stand area to discuss each group's results. Show these results on the "Alpine Forest Data Summary Table" and answer the discussion questions.

Suggested Extensions:

At the park:

Visit the park's natural history museum and hike to the observation tower.

Back at the school:

1. Lay out plots in a forest near your school. Collect data like that on the "Alpine Forest Worksheet." Complete a large data summary table, similar to the "Alpine Forest Data Summary Table," and compare the forest near your school to the forest on Mount Mitchell.

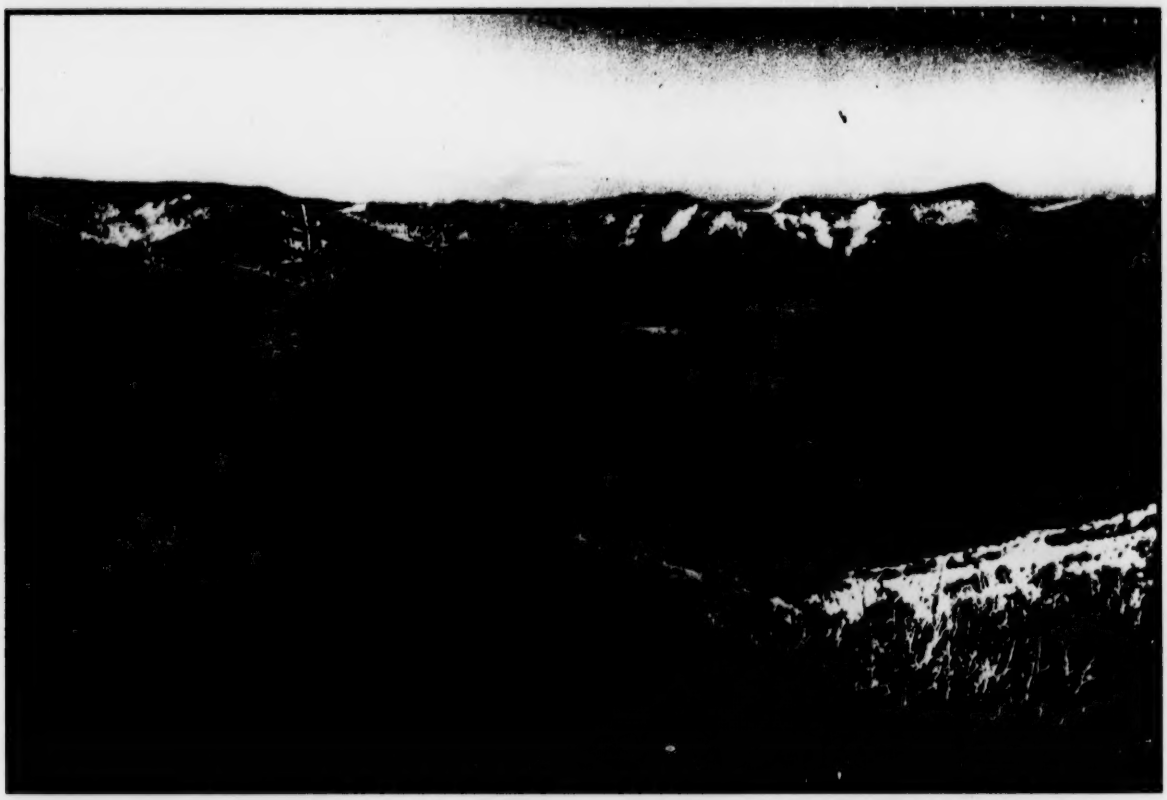
2. Determine the total area of your plot.

Area = pi x radius squared

Answer: The string length (15 feet) is the radius of the circle. Fifteen squared (15 x 15) = 225. 225 x pi (3.14) = 706.5 sq. ft.

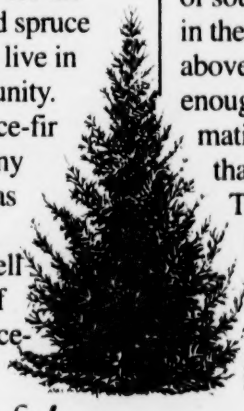
3. Complete the "Alpine Forest Worksheet" and "Alpine Forest Data Summary Table" a second time using the metric system.

Student's Information



Ecology is defined as the study of the relationships between **organisms** and their environments. The environment includes both living and nonliving things. For example, the environment of a tree includes the air that surrounds it, the weather that affects it, the animals that eat it or nest in it, the soil beneath it, and the other plants, that live nearby. The relationships of the tree to its environment are constantly changing. The tree itself changes as it grows older.

The tree belongs to a **natural community** just as you belong to a human community. A natural community includes all the plant and animal populations that interact with each other and share a common environment. Usually a natural community is named for the most abundant trees, or other plants, in that environment. The spruce-fir forest, for example, is named for the dominant trees (red spruce and Fraser fir) that live in this natural community. However, the spruce-fir forest contains many other plants, such as mountain ash and yellow birch, as well as an assortment of animals. The spruce-fir forest is the **alpine** (high elevation) forest in North Carolina.



The climate is one of the major environmental factors that affects the natural community on top of Mount Mitchell. Due to the high elevation, the climate on Mount Mitchell is very similar to that of southern Canada. Peaks in the Southern Appalachians above 5,500 feet are high enough that they have a dramatically different climate than the rest of the state. The air is thinner and colder, and the winters are cold and long. In fact, the coldest temperature ever recorded in North Carolina was on

Mount Mitchell in January of 1985, when the thermometer reached -34 degrees Fahrenheit.

Winds of 100 miles per hour are common in the winter. The winds on Mount Mitchell usually come out of the west. You can infer this from the shape of the trees. Instead of being cone-shaped like Christmas trees, the trees on Mount Mitchell have short branches on the west side and longer branches on the east side. Branches on the west side of the tree where the wind is strongest get broken, while those branches growing away from the prevailing wind are protected by the tree's trunk. These trees are called "flag" trees because their long branches point in the direction the wind is going, just like a real flag.

Most plants become **dormant** to survive the harsh winter conditions. They enter a resting stage in which some of their life processes are slowed down. They drop their leaves and thicken their sap so that it acts like antifreeze. These types of plants are called **deciduous**. **Evergreen** plants such as the red spruce, Fraser fir, mountain laurel and rhododendron have waxy leaves that help keep these plants from drying out in the cold, dry, windy winter air.

Another factor affecting plants is the **pH** of the soil they grow in and the precipitation that falls on them. Everything we eat or drink has a pH and so does the soil at your feet. Scientists use the pH scale to define degrees of acidity. The scale is represented by numbers from 1 to 14. A pH of 1 is extremely **acidic**, while a pH of 14 is extremely non-acidic, or **basic**. A pH of 7 is neutral, neither acidic nor basic. Pure water has a neutral pH of 7. Some examples of the pH of common things around you include:

Vinegar	pH of 2.25
Cola	pH of 4
Rain	pH of 5.4
Milk	pH of 6.5
Sea water	pH of 7.5

pH Scale

1----------7----------14

acidic neutral basic

Soils that have a pH close to neutral are considered "rich" because many minerals and nutrients are readily available. Acidic soils, on the other hand, are often called "poor" because the minerals tend to "leach" or wash out of them easily. Thus, the pH of soil is an important factor in determining which plants can thrive in a given environment.

The soil on Mount Mitchell is acidic. It is not acidic enough to hurt you, but it may be hurting the plants and animals that live on Mount Mitchell as the soil becomes more acidic due to **acid rain**.

As the example listed shows, rain water has a normal pH of 5.4, meaning it is slightly acidic. Unfortunately, the pH of rain water has changed dramatically in the past 20 years. Some of the rain falling on Mount Mitchell has had a pH as low as 3. This means that the rain water is very acidic which is why it is called acid rain. This type of rain also affects the pH of the soil, making it more acidic as well. Many scientists believe that as the soil becomes more acidic, the trees growing on Mount Mitchell, and in other alpine forests worldwide, will become sick and die.

What causes acid rain? Sometimes nature makes acid rain when a volcano belches out sulfur dioxide gas which mixes with rain water. But most acid rain is caused by people and the things we do. The gases that come from the tail pipes of our cars and from the smoke stacks of our factories, especially coal burning electrical plants, all contribute to acid rain.

Scientists use a variety of tools to measure pH. One simple tool is **litmus paper**. When litmus paper is dipped in water or a wet soil solution, it changes color. This color is compared to a spectrum of colors on a color gauge. Each color on the color gauge correlates to a known pH. When the matching color is found, the pH can be determined from the gauge. You and your group will use litmus paper to determine the pH of the soil on Mount Mitchell.

litmus paper

Alpine Forest Fact Sheet

There are many ways plants can be categorized. The following categories relate to question #3 on the "**Alpine** Forest Worksheet."

Shrubs: Woody plants that usually branch from the base with several main stems, not usually from a single trunk.

Trees: Usually tall, woody plants, distinguished from shrubs by comparatively greater height, and characteristically a single trunk rather than several stems.

Grasses: Plants with long slender leaves which are often rolled inward.

Ferns: Any flowerless, seedless plants, having fronds with divided leaflets, and reproducing by means of spores.

Herbaceous plants: Plants that have flowers and seeds. They have fleshy stems, as distinguished from the woody tissue of shrubs and trees. They generally die back at the end of each growing season.

Vines: Plants that have flexible stems and support themselves by climbing, twining, or creeping along a surface.

The plants and animals that live above 5,500 feet in the Southern Appalachians do so because they have **adapted** to the alpine environment of Mount Mitchell. Many of these same plants and animals are also found living in southern Canada where environmental factors are similar, especially rainfall and temperature patterns.

There are only four common tree species found within Mount Mitchell State Park's 1,600 acres. In a tropical rain forest of this size there could be as many as 500 species of trees. This shows that fewer species are able to adapt to harsher environments.

There are only two **evergreen** trees commonly found on Mount Mitchell: Fraser fir (*Abies fraseri*) and red spruce (*Picea rubens*). Both of these trees are **coniferous**.

The Fraser fir is the most abundant tree in the park.

Fraser fir is also known as **balsam** because of its aromatic odor. On young Fraser fir tree trunks, resin blisters are more pronounced than on the trunks of red spruce. The needles of the Fraser fir are flat and rounded at the tips. Both the needles and the branches are also soft to the touch. Gray or whitish stripes are present on the underside of the needles, giving the underside of the branches a grayish or whitish appearance. The cones, when present, project upward from the branch.

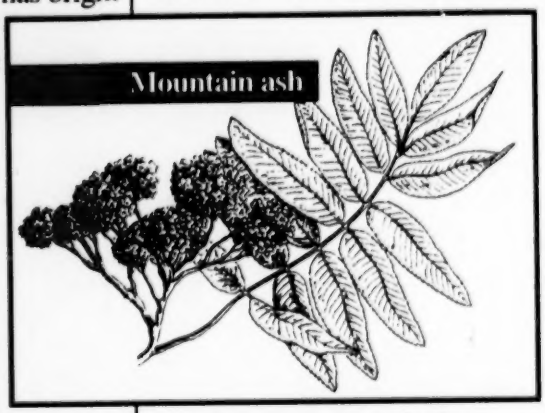
Red spruce, when viewed from a distance, looks very similar to the balsam. Closer examination, however, will reveal that the needles are four-sided or nearly round in cross section as opposed to the flattened needles of the Fraser fir. Also, the needles are stiff, pointed, and sharp to the touch. The cones, when present in the fall, project downward from the limb. The easiest way to distinguish these two trees is to remember that spruce trees have sharp needles.

Red spruce needles & cone

Fraser fir, needles & cone

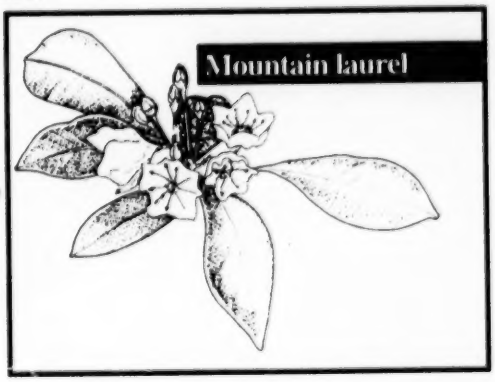
There are only two common **deciduous** trees found along the Balsam Trail: the mountain ash (*Sorbus americana*) and the yellow birch (*Betula lutea*).

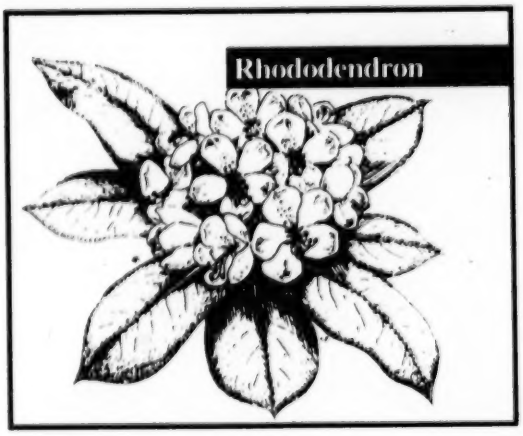
The mountain ash has bright red berries in the fall and winter which are a favorite food for bears and birds, especially grouse, grosbeaks and cedar waxwings. In the spring and summer, the tree is easily identified by its compound leaves.



The yellow birch can be distinguished from the mountain ash by its simple, serrated leaves, with fuzzy veins on the bottom of the leaf. This tree does not have berries, but winged seeds. The leaves and twigs give off a wintergreen odor if crushed.

There are nine shrub species found on Mount Mitchell. Among these, mountain laurel (*Kalmia latifolia*) and purple rhododendron (*Rhododendron catawbiense*) are the two most common evergreen shrubs. Both have shiny, waxy leaves but the laurel's leaves are smaller than the rhododendron's. The easiest way to tell these two shrubs apart is to remember that the one with the longest name, rhododendron, has the longest leaves.





Alpine Forest Worksheet

Post #: _____ Date: _____

School: _____

Group members: _____

_____

_____

_____

As a group, supply the following information.

1. Weather description

Temperature, wind speed, and wind direction can be obtained from the weather information display. This is located in the breezeway between the two concession stand buildings near the summit parking area. Fill in the appropriate information below.

Temperature: _____ Wind Speed: _____ Wind Direction: _____

Circle today's weather conditions. You can circle more than one weather description or state today's weather in your own words in the space below.

rainy sunny cloudy foggy windy calm

_____

_____

2. What side of the mountain are you on? _____

Clue: The road that you traveled on to get to the park runs in a northerly direction and the Balsam Trail is located to the right of that road.

3. Plot description:

Circle the types of plants growing in your plot. You can circle more than one type of plant.

trees shrubs grass ferns vines herbaceous

Which one of these types of plants covers the biggest portion of your plot?

_____

In your plot, a low growing plant such as a tree seedling would receive how much sunlight? (circle your answer)

little sunlight a lot of sunlight

Why? Explain. _____

_____

Are there any animals or signs of animals in your plot? (Do you see tracks, hair, insects, spiders, etc.?) Circle your answer.

yes no If yes, write down what animals or animal signs you saw.

_____

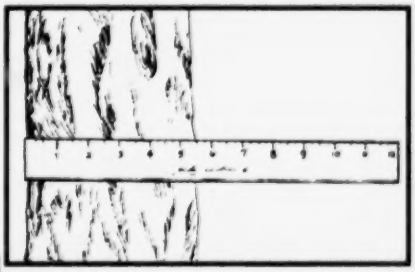
_____

4. Tree survey

To begin sampling the plot, one student should hold one end of the string on the top of the numbered post while another student holds the other end of the string, keeping the string straight and fairly tight. The second student will be 15 feet from the numbered post. This student should mark where he/she is standing by making a line on the ground, laying a stick down, or putting a stick in the ground as a marker. After marking the spot, the second student will walk in a circle around the numbered post. Every time the string touches a tree, the third person in the group should record that tree's data on this worksheet. The data from all the trees within the group's 15-foot circle must be obtained.

First, determine the tree's species using the "Alpine Forest Fact Sheet." Place its name (common and/or scientific) in the data table below. If there are standing dead trees in your plot, do not try to determine the species. You will just count them.

CAUTION: A standing dead tree can be dangerous! Do not get too close, or touch the tree. The top could break off, fall and injure you. Do not try to measure the diameter of a dead tree.



You will measure each live tree's diameter. Hold the ruler against the tree about four and one half feet above the ground. Close one eye, tilt your head to the left and line up the left side of the tree with the zero mark on the ruler. Hold the ruler steady, tilt your head to the right, still keeping one eye closed, and line up the right side of the tree with the ruler. The number on the ruler at the right edge of the tree is the tree's diameter in inches. Record this number below.

Record every tree and its diameter on this worksheet as you complete the circle by walking around the numbered post. Remember to use the illustrations and descriptions found in the "Alpine Forest Fact Sheet" to identify the plants. Under **Health,** write a few words describing the condition of each tree you measure. For example, if the tree has few, or no dead branches, describe it as "healthy." If the tree has some dead branches try to estimate how much of the tree is dead. Use a fraction such as 1/4, 1/3 or 1/2 "dead."

	Tree Species	**Diameter**	**Health**
Tree 1	_____	_____	_____
Tree 2	_____	_____	_____
Tree 3	_____	_____	_____
Tree 4	_____	_____	_____
Tree 5	_____	_____	_____

Tree 6 _____ _____ _____

Tree 7 _____ _____ _____

Tree 8 _____ _____ _____

Tree 9 _____ _____ _____

Tree 10 _____ _____ _____

Tree 11 _____ _____ _____

Tree 12 _____ _____ _____

Total number of yellow birch _____ Total number of mountain ash _____

Total number of Fraser fir _____ Total number of red spruce _____

Total number of live trees _____ Total number of standing dead trees _____

Average of the diameters of yellow birch _____

Average of the diameters of mountain ash _____

Average of the diameters of Fraser fir _____

Average of the diameters of red spruce _____

Average of the diameters of all the trees _____

5. Soil pH

After collecting the tree data, measure the pH of the soil in your plot. You will do this by using the cup, the distilled water, and litmus paper given to you earlier. By hand, collect enough soil from your plot to fill one quarter of the cup. Put enough distilled water in the cup so that the soil and water together fill one half of the cup, then stir the soil and water using any small stick you find. (Remember, breaking of plants in a state park is prohibited - use a dead stick already on the ground.) Place a two-inch piece of litmus paper in the muddy water and compare the color change on the litmus paper with the litmus color chart.

Record your findings here. Soil pH _____

Circle which best describes your plot's soil: acidic neutral basic

How would you describe the soil in your plot in terms of moisture? Pick the soil up and squeeze it in your hand. Does it stick together and hold its form after you open your hand? If it does, that means the soil is moist. Does the soil fall apart after you squeeze it and then open your hand? If it does, that means the soil is dry.

Circle your answer. moist dry

What is the soil's color? _____

What is the soil's texture? Does the soil feel sandy, smooth, gritty or soft when you rub it between your fingers?

_____

6. After you complete this worksheet, return to the summit parking area.

7. Each group will present the data collected from their plots. The educator will record this information on the "Alpine Forest Data Summary Table." You will discuss what you learned about the spruce-fir forest on Mount Mitchell.

Alpine Forest Data Summary Table

Plot #	Soil pH	Yellow Birch	Mountain Ash	Red Spruce	Fraser Fir	Total # Live Trees	Total # Dead Trees
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Example: you could write down the average diameter or list all diameters as shown here.

Plot #	Yellow Birch	Mountain Ash	Red Spruce	Fraser Fir	Dead Trees
1	3 trees, 8",10",12"	2 trees, 6", 3"	2 trees, 12", 4"	2 trees, 6",12"	4 trees

Discussion Questions

Was the data from each of the plots the same?

(Answer: No two plots will be exactly alike. But, by taking the average of all the plots we get a better concept of the different kinds, numbers and sizes of trees that are growing in the spruce-fir forest.)

Of the four most common trees growing on Mt. Mitchell, which is the most abundant?

What is the second most abundant tree?

What is the third most abundant tree?

Which is the least abundant tree?

Which plot had the greatest number of trees?

Which plot had the least number of trees?

Which plot had the largest diameter tree and what was the species?

How many dead trees were found in the plots?

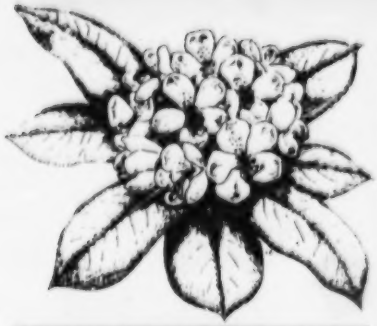
What was the health or condition of the live trees in each plot?

How might the data in each of the plots change over time? (Ask students to give their predictions.)

(Answer: We believe that the plots will change over time, but no one really knows how. The data the students collected can be compared to data collected by other classes and possibly by researchers. Data collected like this over time is a very valuable tool for researchers, for this is one of the best ways to find out how the spruce-fir forest is changing.)

What is different about the spruce-fir forest compared to the forests growing where you live?

Post-Visit Activity #1 — Forest Game



Curriculum Objectives:

Grade 4
- Arts Education: develop creative drama skills
- Communication Skills: listening, comprehension
- Guidance: competency for interacting with others
- Science: living things—animals, adaptation to environment, weather and climate
- Social Studies: participate effectively in groups

Grade 5
- Arts Education: participate in creative dramas
- Communication Skills: listening, comprehension
- Guidance: competency for interacting with others
- Science: living things—plants, earth science, environment
- Social Studies: participate effectively in groups

Grade 6
- Arts Education: participating effectively in creative drama activities, develop positive attitudes
- Communication Skills: listening, comprehension
- Guidance: competency and skill for interacting with others
- Healthful Living: environmental health, how people affect the environment
- Science: ecology

Location:
A field, or somewhere outside with plenty of space

Group Size: Any

Estimated Time: 40 minutes

Appropriate Season: Any

Materials:
Provided by the Educator:
Per student: one copy of the Student's Information sheet
Per group: One pound of dried beans and two 1-gallon plastic buckets

Major Concepts:
- Environmental factors affecting forest growth

Objectives:
- List five elements that can adversely affect natural communities.
- List three ways to help protect the spruce-fir forest.

Educator's Information:

This activity is a simulation where the students role play various members of a **natural community** which are working together to keep the forest alive. The main objective of this forest simulation is reproduction and survival. The manner in which the alpine forest in this activity reproduces, and therefore survives, is by moving its seeds from the bucket containing beans to the empty bucket. A healthy forest will regenerate (create young trees) very quickly.

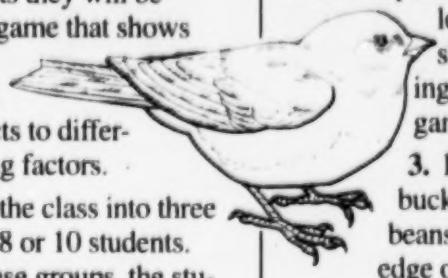
There will be no talking during the game. Natural community members must communicate with each other in ways other than using words. If the members of the natural community need to communicate, they should do so by quietly simulating their given parts, i.e. birds may chirp, trees can be blown by the wind, etc.

It is also important for the students to listen carefully. Forest creatures need to know what is going on around them. The educator will be telling a Forest Story, and students will be acting it out, but they won't be able to hear their part if they are not listening.

BEST COPY AVAILABLE

Instructions:

1. Discuss the Student's Information with the class. Introduce the new vocabulary words, **limiting factor** and **balsam woolly adelgid**. Tell the students they will be playing a game that shows how the spruce-fir forest reacts to different limiting factors.



2. Divide the class into three groups of 8 or 10 students. Within these groups, the students will count off by "3"s, as the students will be role playing three different natural community members. The "ones" will be Fraser firs, the "twos" will be red spruce trees, and the "threes" will be slate-colored juncos.

Explain the characteristics of each species and have the students role play their parts using the following descriptions, or roles they make up:

a. Red spruce trees are tall **evergreen** trees with short, sharp pointed needles and cones that hang down from the branches. All students playing red spruce trees should stand up as tall as they can, hanging their hands down to represent cones.

b. Fraser fir trees are tall evergreen trees with short needles, but they have cones that stand up on their branches. All students playing Fraser fir trees should stand tall with their hands pointed up to represent cones.

c. Slate-colored juncos are small birds that hop around on the ground and pick up small seeds to eat, thus dispersing seeds over a larger area. They make a loud chirping noise. All the students playing juncos should hop around and chirp loudly. Juncos should hop during the whole game.

3. Place the buckets containing beans in a line on one edge of the field, about three to four feet away from each other.

4. Place empty buckets directly across from the buckets containing beans, approximately 30 yards away. (Do not place the buckets too far apart because you will need to be heard clearly by everybody.)

5. Have the groups line up behind their bucket of beans.

6. When the educator says "go," each student is to take one bean from the bucket of beans for their group and start walking (or hopping) quietly over to their group's empty bucket. Everyone should put their bean into their group's empty bucket and walk or hop quietly back to get another bean. Continue this cycle until other directions are given. This is not a relay race - speed is not the object of this game. All the students can be coming and going at the same time, being careful not to knock over the buckets. (Remind the juncos to keep hopping.)

7. Let this process continue for awhile, to get everyone used to the cycle.

8. When the educator says "stop," every natural community member should stop where he or she is and listen to the instructions. Follow those instructions until new ones are given. If new instructions are not given for a particular species (fir, spruce, junco), that student will continue doing what he or she was doing before. If the student is given new instructions, he or she should act out this new role in addition to what he or she was doing before. Students should not begin role playing again until the educator says "go!"

Note:
This activity is especially fun when the directions are given dramatically. Also, the story presented here is only one version. We encourage you to make it more complicated, or to simplify it. See the Suggested Extensions.

Suggested Extensions:

1. To demonstrate that different natural communities have to contend with different factors (in terms of elevation, etc.), have the buckets at different distances for different groups.

2. Repeat the game using any of the following additional elements or any that you or your students create:

- Logging
- Destructive caterpillars
- Good soil due to decay
- People planting seedlings
- Flood
- Second home development

Forest Story:

Note: Leave appropriate pauses after each step in the story.

1. You are all parts of a healthy **spruce-fir forest**. You get rain and sunshine in just the right amounts. Go!

2. Then one year, there is a drought. Stop!

All the trees and birds in the forests have less water to drink, and this slows down their ability to reproduce. Everyone must go in slow motion. Go!

3. Because everything is so dry that summer, there is a fire. Stop!

The fire kills all of the trees. Trees - (this is where things get dramatic) act like you are dying. Now lay on the ground, dead. Birds - you escape to nearby forests and you are okay. Go!

4. Trees - You decompose until the next spring, enriching the soil as you do so. Stop!

With the coming of spring rainfall, tree seedlings start to grow. Dead trees - you are now young trees of the same species that you were before. Go!

5. The next winter, there is a very heavy ice and snow storm. Stop!

The snow is so heavy that the fir trees can not hold the weight of the snow. Many of their branches break off. This means that they have fewer needles to make food in the spring. Fir trees must hop on one foot. Go!

6. That same winter, another storm comes, and winds hit the mountains at speeds up to 100 miles an hour. Stop!

All the spruce trees lose a lot of their branches, which means they have fewer needles to make food in the spring. None of the spruce trees may use their hands to carry beans. They must have help from the juncos or fir trees to get a bean out of the can and put it in their pockets, or on top of their heads, or in their socks, etc. If a "spruce tree" loses his or her bean, someone else must help him or her get it back. Go!

7. One night, temperatures drop to the coldest temperatures ever experienced in North Carolina. The temperature reaches -34 degrees **Fahrenheit**, which is really cold! Stop!

This affects all the plants and animals in the forest. In addition to what the trees were doing before, the juncos must now walk or hop while bobbing their heads up and down. Go!

8. Now it is spring! The trees are still trying to recover from the winter storms. A city, which is 60 miles away, is polluting by putting sulfur and nitrogen into the air. Stop!

The extra sulfur and nitrogen in the air is contributing to acid rain. The acid rain makes it even harder for the injured trees to make food. In addition to what they were doing before, each tree must now twirl in circles. Juncos have recovered from the winter cold and can now hop normally. Go!

9. Some **balsam woolly adelgids** come to the forest and start eating the fir trees. This insect injects a substance into the bark of the trees, which makes it hard for the fir trees to transport food and water. Stop!

Combined with the effect of acid rain, this eventually kills all the fir trees. All the fir trees - Lie down dead. Go!

10. The humans have discovered ways to reduce air pollution and to control the balsam woolly adelgids. Stop!

Scrubbers were put in the smokestacks of coal-burning electric power plants. Trees will no longer have to twirl around because acid rain has been reduced. Spruce trees have also recovered from the wind damage and can use their "hands" again to pick up beans. The fir trees begin to regenerate after the last attack of the adelgid and acid rain. Fir trees may reproduce again, but they must walk in slow motion. Go!

11. We will stop our simulation at this point, with our natural community recovering from the effects of several limiting factors. Stop!

Note: Students may want to count the number of beans their natural community was able to transport during the game.

12. After completing the game, collect all the beans and buckets.

Find a tree on the school's campus and have the class sit in its shade. Discuss the limiting factors that affect this tree's growth. Examine the tree for signs of stress. Think back to the class visit to Mount Mitchell. What are the differences and similarities regarding the limiting factors which affect this tree and those of the **spruce-fir forest** on Mount Mitchell?

How was this simulation game like a real natural community? (Answer: Different natural communities respond differently to environmental stresses depending on their health, their elevation, which side of a mountain they are growing on, etc. There are many limiting factors that affect a natural community. The interactions between the various members of a natural community change due to their response to these factors.)

How was this simulation game not like a real natural community? (Answer: Trees really can't move. Storms and winds affect all the trees instead of only one kind of tree, etc.)

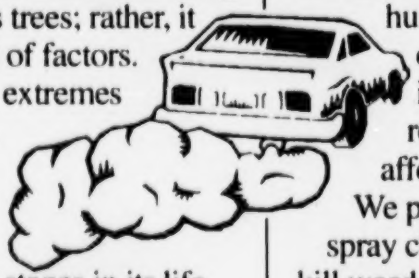
What did it feel like when you were not able to get the bean in the can as easily as you could at the beginning of the game? What limiting factor, or combination of limiting factors, made it the most difficult for you to survive and reproduce?

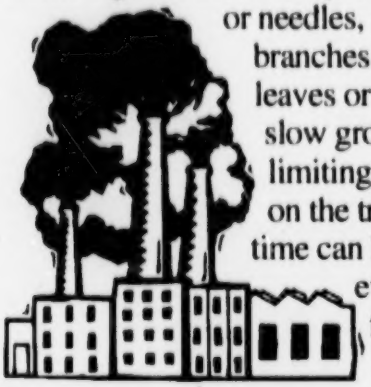
Is there anything we can do to help protect the sruce-fir forest like the one we simulated? (Answer: There are many things we can do. For example, learn more about the forest and how it functions so that we can appreciate it and use it more wisely; use less paper and recycle paper so fewer forest communities are cut down; work in your local community to reduce the amount of pollution by doing such things as riding a bicycle, walking instead of driving, and using less electricity so the power plants do not need to produce as much; write letters to the city council and to state and federal legislators expressing your concern about protecting natural communities such as the spruce-fir forest on Mt. Mitchell.)

Student's Information

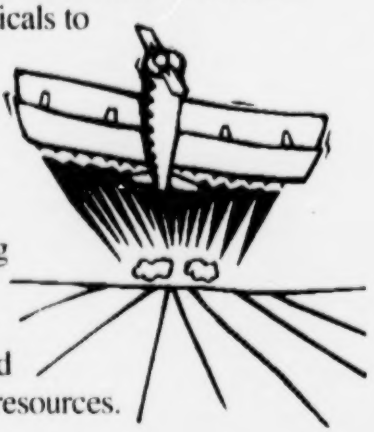
Dead trees on Mount Mitchell

Various factors can contribute to forest decline. Very seldom is there one **limiting factor** that stunts or kills trees; rather, it is usually a combination of factors. Limiting factors such as extremes of climate, air pollution, diseases, and insects (such as the **balsam woolly adelgid**) will weaken a tree at various stages in its life. Some signs of stress are yellowed leaves or needles, wilted or dead branches, deformed leaves or needles, and slow growth. Several limiting factors acting on the tree at the same time can kill the tree or even an entire forest.





Many plants and animals affect **natural communities**, but none more so than humans. We clear-cut forests and often plant only one tree species in their place. We build dams, roads, and developments which affect the natural world around us. We pollute the air and water, and spray chemicals to kill weeds and insects. As our population continues to grow, we are placing even greater demands on our forests and other natural resources.



VOCABULARY

Acidic - Having a pH less than 7; the chemical state of water or other substance in which the hydrogen (H+) ions exceed the hydroxyl (OH-) ions. For example, a car's battery acid has a pH of 1. See pH.

Acid rain - Rain, or other precipitation, having a pH below the normal pH of 5.4, usually caused by air pollution from vehicle exhausts and coal burning furnaces.

Adapted - Changed or developed to best survive a particular environment. For example, forests develop only where soil types, moisture and sunlight are balanced to the proper degree. Mountain plants have made adjustments, so they are able to live at high altitudes with intense cold, on poor quality soils.

Alpine - Of, or pertaining to, high mountains.

Balds - Natural grasslands or shrub thickets occurring on high mountain peaks.

Balsam - Any of the various trees yielding an aromatic, resinous substance, especially the balsam fir.

Balsam woolly adelgid - *Adelges piceae*, is a small sucking insect that attacks only fir trees (*Abies species.*). This pest was introduced into eastern North America from Europe at the turn of this century.

Basic - Having a pH greater than 7; the chemical state of water or other substance in which the hydroxyl (OH–) ions exceed the hydrogen (H+) ions. For example, soap has a pH of 10. See pH.

Coniferous - Any tree that bears cones–such as pine, Fraser fir, and red spruce.

Cove hardwood forest - These forests occur in the Southern Appalachians in sheltered mountain valleys on north- and east-facing slopes, from 1,500 to 4,500 feet. Cove forests are among the richest, most magnificent deciduous forests found anywhere on earth.

Deciduous - Trees and shrubs which lose their leaves during seasonal changes.

Diameter - The thickness or width of anything, especially a circle or sphere.

Dormant - A relatively inactive or resting condition in which some processes are slowed down or suspended.

Evergreen - Having foliage that persists and remains green throughout the year.

Fahrenheit - A temperature scale that registers the freezing point of water at 32 degrees Fahrenheit and the boiling point of water as 212 degrees Fahrenheit under standard atmospheric pressure.

Natural community - A collection of populations of plants and animals that associate with each other and their physical environment.

Gradient - An ascending or descending part; an incline.

Limiting factor - An environmental condition that, when present in too great or too little an amount, has a negative effect on the survival of a species or population.

Litmus paper - Specially treated paper used as an acid-base indicator.

Migration - The movement of animals from one region to another by chance, instinct or plan.

Northern hardwood forest - These forests occur at higher elevations, between 3,500 and 5,500 feet. They are like those found in the New England states, and are comprised primarily of American beech, sugar maple, yellow birch and eastern hemlock.

Oak-hickory forest - These forests occur over the southern- and eastern-facing outer slopes of the Blue Ridge Mountains below 3,500 feet and in the interior mountain basins. These stands are typically dominated by white oak with chestnut; black and scarlet oaks are also abundant.

Organism - Any living individual; any plant or animal.

pH - (p)otential of (H)ydrogen ion activity; a measure that indicates the relative acidity or alkalinity (basicity) of a substance. The pH scale is a logarithmic scale ranging from 0 (most acidic) to 14 (most basic), with a pH of 7 being neutral.

Piedmont - An area lying at the foot of a mountain or mountain range.

Plot - A small piece of ground, generally used for a specific purpose. A measured area of land.

Spruce-fir forest - Coniferous forests of the northern United States, southern Canada, and peaks in the Southern Appalachians above 5,500 feet.

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SCHEDULING WORKSHEET

For office use only:
Date request received_____ Request received by_____

1) Name of group (school) _____

2) Contact person _____ _____
name phone (work) (home)

_____
address

3) Day/date/time of requested program _____

4) Program desired and program length _____

5) Meeting place _____

6) Time of arrival at park _____ Time of departure from park _____

7) Number of students _____ Age range (grade) _____
(Note: A maximum of 30 participants is recommended.)

8) Number of chaperones _____
(Note: One adult for every 10 students is recommended.)

9) Areas of special emphasis _____

10) Special considerations of group (e.g. allergies, health concerns, physical limitations)_____
_____

11) Have you or your group participated in park programs before? If yes, please indicate previous programs attended: _____
_____

12) Are parental permission forms required? _____ If yes, please use the Parental Permission form on page 8.2.

I, _____, have read the entire Environmental Education Learning Experience and understand and agree to all the conditions within it.

Return to: Mount Mitchell State Park
Route 5, Box 700
Burnsville, NC 28714

Fax: (704) 675-4611

PARENTAL PERMISSION FORM

Dear Parent:

Your child will soon be involved in an exciting learning adventure - an environmental education experience at **Mount Mitchell State Park**. Studies have shown that "hands-on" learning improves children's attitudes and performance in a broad range of school subjects.

In order to make your child's visit to "nature's classroom" as safe as possible, we ask that you provide the following information and sign at the bottom. Please note that insects, poison ivy and other potential risks are a natural part of any outdoor setting. We advise that children bring appropriate clothing (long pants, rain gear, sturdy shoes) for their planned activities.

Child's name _____

Does your child:

- Have an allergy to bee stings or insect bites?_____
  If so, please have them bring their medication and stress that they, or the group leader, be able to administer it.

- Have other allergies? _____

- Have any other health problems we should be aware of?_____
  _____

- In case of an emergency, I give permission for my child to be treated by the attending physician. I understand that I would be notified as soon as possible.

_____ _____
Parent's signature date

Parent's name _____ Home phone _____
(please print) Work phone _____

Family Physician's name _____ phone _____

Alternate Emergency Contact

Name_____ phone _____

NORTH CAROLINA PARKS & RECREATION
PROGRAM EVALUATION

Please take a few moments to evaluate the program(s) you received. This will help us improve our service to you in the future.

1. Program title(s) _____ Date _____
   Program leader(s) _____

2. What part of the program(s) did you find the most interesting and useful? _____
   _____

3. What part(s) did you find the least interesting and useful? _____
   _____

4. What can we do to improve the program(s)? _____
   _____
   _____

5. General comments _____
   _____
   _____
   _____

LEADERS OF SCHOOL GROUPS AND OTHER ORGANIZED YOUTH GROUPS
PLEASE ANSWER THESE ADDITIONAL QUESTIONS:

6. Group (school) name _____

7. Did the program(s) meet the stated objectives or curriculum needs? _____
   If not, why? _____
   _____

Please return the completed form to park staff. Thank you.

Mount Mitchell State Park
Route 5, Box 700
Burnsville, NC 28714
Fax: (704) 675-4611